NIBIO POP

NIBIO
NORWEGIAN INSTITUTE OF BIOECONOMY RESEARCH

VOL. 3 - NO. 19 - JUNE 2017

Photo: Oskar Puschmann / NIBIO

From Rennesøy, Rogaland County.

3Q: Monitoring agricultural landscapes in Norway

Agricultural landscapes are products of farming activity in the past and present. They are everyday landscapes for many people and are important for outdoor recreation. Many plant and animal species find their habitat in these landscapes, and a high number of cultural heritage sites can also be found there. At the same time, agricultural landscapes are continuously subject to change. To ensure sufficient information on how these landscapes change, a national monitoring programme with the acronym "3Q" was initiated in 1998, to document status, continuity and change in agricultural landscapes in Norway. The Division of Survey and Statistics at NIBIO is responsible for the programme.

CHANGE IS ELUSIVE

Many driving forces influence agricultural landscapes. Examples are technological development within the farming sector, the market situation for farm products, agricultural policies, demography, socio-economics and infrastructure development. Some landscape changes are intentional and appreciated, other changes are unintentional and possibly problematic. In both cases, it can be difficult to obtain a comprehensive overview of the process or assess the true extent of the changes, in particular when changes occur gradually over time, or are geographically scattered.

IMPACT OF NATIONAL POLICIES

The 3Q programme reports indicators of land use and spatial organization, biological diversity, cultural heritage, and accessibility of agricultural landscapes. The indicators measure whether the overall goals formulated in agricultural and environmental policies are achieved. The programme reports at national and regional levels, for time periods of five years. The aim of the programme is to

- document effects of agri-environmental policy instruments and increase the probability of achieving environmental objectives.
- strengthen the basis for developing new environmental objectives and new tools or management strategies for achieving these.
- enable comparisons between different regions of Norway and with other countries.

MONITORING METHODS

The 3Q programme is based on mapping agricultural landscapes in sample squares of 1 x 1 km distributed throughout the entire country. The maps are based on interpretation of aerial photographs and are used to calculate indicators and statistics for the agricultural landscape of Norway. Reporting is frequently done for larger regions like counties or "agricultural regions" (Nersten et al. 1999). Most 3Q indicators are linked to land use and land cover. Examples are field size and shape, land cover types within a 10m buffer zone around surface waters, length of elements such as lines of trees or stone walls, and numbers of elements like farm ponds or semi-natural non-crop "islands" in fields.

Photo: Oskar Puschmann / NIBIO

Cereal field, Melhus, Sør-Trøndelag County.

Cultural heritage objects and environments are primarily monitored by surveying the land use and land cover immediately surrounding localities previously registered in the national cultural heritage database or identified through fieldwork. Biodiversity is monitored through surveying the amount, distribution and diversity of different types of habitats. Since the potential of aerial photo interpretation is somewhat limited with regard to both these topics, supplementary fieldwork is carried out on selected monitoring squares. Buildings and other cultural heritage objects are surveyed, occurrence and distribution of vascular plants are investigated in semi-natural grasslands, and birds are recorded in cooperation with the Norwegian Ornithological Society. In addition, visual aspects of the agricultural landscape are documented through on-the-ground-photography, aiming to capture both landscape character and landscape elements. For all field observations, geographical coordinates are recorded so that the exact sites can be re-visited to record change over time.

SELECTION OF MONITORING SQUARES

The procedures for data capture in 3Q have been slightly modified since its initiation in 1998. When the third round of data capture began in 2012, a larger modification was implemented in that a new sample of monitoring squares was established. The main reasons for this were to increase mapping efficiency, reduce the uncertainty of estimates associated with marginal farming landscapes, and simplify the method of upscaling results from sample squares to regional or national level.

A criterion of the original selection of monitoring squares had been the occurrence of farmland[1] at the centre of the square. This resulted in areas with much farmland being overrepresented in the sample. Originally this effect was intended, to ensure that the largest possible amount of farmland was captured within the monitoring squares. However, an undesirable side effect was a large uncertainty of estimates for landscapes with little farmland.

Interest in marginal agricultural landscapes has increased over time. These areas are clearly influenced by agriculture, but typically with smaller and more

[1] Farmland as defined for the national Area Resource Map (AR5) includes fully cultivated (ploughed) and surface-cultivated fields, and enclosed pasture (Ahlstrøm et al. 2014).

Photo: Oskar Puschmann / NIBIO

Agricultural landscape, Valle, Aust-Agder County.

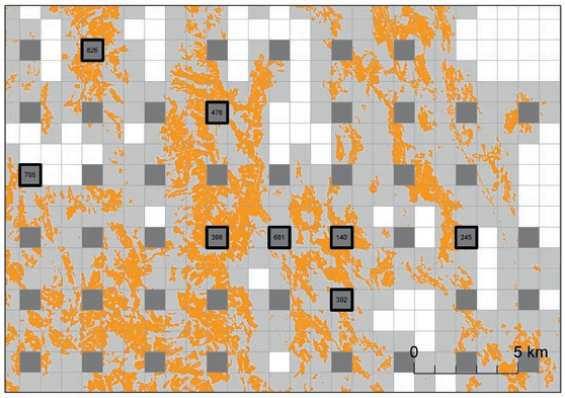

Figure 1: Agricultural area from the «Area Resource Map AR5» (orange) superimposed on a 1 x 1 km grid. All squares containing agriculture are coloured grey. Every third square that also contains agricultural area is coloured dark grey. The 3Q monitoring programme uses a random selection (outlined in black) of squares in the 3 x 3 km grid that contain agricultural land.

scattered fields. Marginal farming landscapes are often most prone to change. Therefore, the original selection of squares was considered suboptimal. The new monitoring squares are still 1 x 1 km in size and distributed throughout the whole country. However, the farmland criterion has been modified, and it is now sufficient that farmland occurs in the square, it does not have to be in the centre. Thus the certainty of estimates is no longer dependent on the amount of farmland in individual monitoring squares. Squares previously selected for fieldwork were retained, to ensure comparability over time.

The basis for the selection of monitoring squares is the standardized nationwide 1 x 1 km grid of Statistics Norway (Strand & Bloch 2009). Every third grid cell is a potential monitoring square, as long as it includes farmland (Figure 1). A random selection was then made by assigning a random number to every such grid cell and selecting the first 1000 of them as monitoring squares. 100 squares (10 %) are further selected for field recording to assess the quality of the aerial photo interpretation. If better statistics are required for a certain region, or for the country as a whole, the number of squares can easily be increased.

AREA MAPPED

Figure 2 shows an example of a 3Q monitoring square. The map is produced on the basis of aerial photo interpretation on a digital work station, using detailed instructions that describe how to demarcate polygon borders. Polygons, lines and point elements are assigned specific attribute codes, and form the basis for the calculation of indicator values. Area statistics and reports on continuity and change in the agricultural landscape refer to all farmland and a surrounding buffer zone of 100 m.

In order to calculate more general landscape indicators, such as diversity of land types or the degree of spatial heterogeneity of the landscape, it is interesting to include the area outside the buffer zone. Through the Norwegian spatial data infrastructure (Digital Norway – a cooperation between public institutions), detailed “Area Resource Maps” (AR5) are now available for the whole country at a scale of 1:5000, and are regularly updated (Ahlstrøm et. al 2014). These maps are not as detailed as the 3Q maps, and change is not recorded in the same way, but they nevertheless supply enough information to characterise the monitoring squares (Figure 3). The data are also comparable over time, provided that the boundaries for the detailed 3Q mapping remain the same.

Figure 2: Detailed instructions are followed to map farmland and all land within 100 metres of farmland. This map shows some of the main land categories.

Figure 3: «Area Resource Maps» (AR5) are used to provide information about land that is more than 100 m from farmland. These maps are less detailed than the 3Q maps.

With the transition to the new sample of monitoring squares, the instructions for aerial photo interpretation were also slightly adjusted. For example, fully cultivated land is no longer classified as cereal or grass production. At certain periods of the year, e.g. after ploughing, it is impossible to accurately identify the type of crop, and other data such as applications for production subsidies can give better estimates of cereals vs. fodder crops.

The Digital Norway infrastructure also provides 3Q with access to aerial photographs. The aim is to re-photograph at five year intervals, but weather conditions often disrupt the plans. If photographs are not available at a five year interval we accept photos with a longer interval, but preferably not less than five years. In order to report change for the new set of sample squares, we map from the most recently available photographs and five years back in time, corresponding to the second round of recording for the original set of sample squares. Reported indicators are adjusted to a five year interval (average annual change multiplied by five).

The number of squares mapped in the old and new sample is about the same, 1000 squares. However, the new squares contain far less agricultural land, so the total area mapped is much smaller. Nevertheless, due to the new method of selecting squares, the uncertainty of regional estimates has not changed much, even though we now use less time mapping. Importantly, where previously estimates were more uncertain for marginal landscapes, the uncertainty is now more equal for all types of agricultural landscape.

REPORTING RESULTS

In addition to map data, 3Q also makes use of other official data sources, such as the database of applications for production subsidies and information about land ownership and rented land. Combining these different data sources can shed more light on how and why land use changes, and whether agri-environmental policies have the desired effect or not. Results from the monitoring programme are presented at an annual open seminar, to which Norwegian agricultural authorities, County Governor's Offices, researchers, farmers' organisations and other interested parties are invited. Norwegian reports are all freely available in pdf-format online, and tables and figures based on the data are also sent to other institutions on demand, e.g. to the Norwegian Agricultural Authority and Statistics Norway for use in their reports about agriculture.

REFERENCES

Ahlstrøm, A.P., Bjørkelo, K. & Frydenlund, J. 2014. *AR5 klassifikasjonssystem: klassifikasjon av arealressurser*. Rapport fra Skog og landskap 06/14, 38p.

Nersten, N.K., Puschmann, O., Hofsten, J., Elgersma, A., Stokstad, G. & Gudem, R. 1999. *The importance of Norwegian agriculture for the cultural landscape: A sub-project under the Ministry of Agriculture's evaluation programme on multifunctional agriculture.* NILF-notat 1999:11. Norsk institutt for jord- og skogkartlegging, Ås, and Norsk institutt for landbruksøkonomisk forsking, Oslo.

Strand, G.-H. & Bloch, V.V.H. 2009. *Statistical grids for Norway: Documentation of national grids for analysis and visualization of spatial data in Norway*. Report 2009/9. Statistics Norway.

AUTHORS:

Grete Stokstad, Wendy Fjellstad, Sebastian Eiter and Wenche Dramstad, Department of Landscape Monitoring
E-mail: grete.stokstad@nibio.no, wenche dramstad@nibio.no

NIBIO **POP** 3 (19) 2017
ISBN 978-82-17-01896-4
ISSN 2464-1170

Specialist editor: Hildegunn Norheim, Director of the Division of Survey and Statistics
Series editor: Arne Bardalen, acting Research Director

nibio.no